NON-PUBLIC?: N
ACCESSION #: 9004180239
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Quad Cities Unit One PAGE: 1 OF 5

DOCKET NUMBER: 05000254

TITLE: Unit One Reactor Scram from a Generator Trip Due to Failure of the Negative Sequence Relay
EVENT DATE: 03/10/90 LER #: 90-004-00 REPORT DATE: 04/09/90

OTHER FACILITIES INVOLVED: Quad Cities 2 DOCKET NO: 05000265

OPERATING MODE: 4 POWER LEVEL: 098

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Bryan Hanson, Technical Staff Engineer, Ext. 2174

TELEPHONE: (309) 654-2241

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On March 10, 1990, Quad Cities Unit One was in the RUN mode at approximately 98 percent of rated core thermal power. At 0114 hours, a reactor scram occurred due to a turbine-generator (TG) load mismatch. The turbine-generator load mismatch was the result of a generator trip. All safety feature actuations occurred as designed. Emergency Notification System (ENS) phone notification was completed at 0209 hours on March 10, 1990, to comply with the requirements of 10 CFR 50.72(b)(2)(ii).

An investigation revealed the cause for this event was a failure of the negative sequence time overcurrent relay. When a fault occurred on line 0402, the relay actuated resulting in a generator trip. The fault was most likely a result of a lightning strike. The relay was repaired.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv).

END OF ABSTRACT

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power.

EVENT IDENTIFICATION: Unit One Reactor Scram from a Generator Trip Due to Failure of the Negative Sequence Relay.

A. CONDITIONS PRIOR TO EVENT:

Unit: One Event Date: March 10, 1990 Event Time: 0114
Reactor Mode: 4 Mode Name: RUN Power Level: 98%

This report was initiated by Deviation Report D-4-1-90-021

RUN Mode (4) - In this position the reactor system pressure is at or above 825 psig, and the reactor protection system is energized, with APRM protection and RBM interlocks in service (excluding the 15% high flux scram).

B. DESCRIPTION OF EVENT:

At 0114 hours on March 10, 1990, Quad Cities Unit One was in the RUN mode at approximately 98 percen
of rated core thermal power. A
reactor RCT! scram JC! occurred due to a turbine TA, TRB! - generator (TG) (EL, GEN! load mismatch. The TG load mismatch was caused by a generator trip which resulted when the negative sequence time overcurrent relay FC, 51! tripped. A severe thunderstorm with multiple lightning ground strikes was present during the time of the scram.

The expected reactor water level transient due to the collapse of voids following the scram caused the reactor vessel RPV! level to drop below +8 inches which resulted in Group II and III Primary Containment Isolations (PCI) JC!, Reactor Building Ventilation VA! and Control Room Ventilation V! isolations, and Standby Gas Treatment BH! initiation.

During the scram recovery, reactor water level was increasing rapidly. The Nuclear Station Operator (NSO) manually closed the 1A feedwater SJ! regulating valve (FRV) 90,V! and tripped the 1B Reactor Feedwater Pump (RFP)P!. The 1B FRV closed automatically as level increased. As level continued to increase, the NSO closed the FRV isolation valves. The NSO attempted to start Reactor Water Clean-Up (RWCU) CE! blowdown, but the open indication light IL! did not illuminate when the MO 1-1201-5 was opened. Because of the confusion caused by loss of indication, initiation of RWCU blowdown was delayed. Because of the combination of the long stroke time of the FRV isolations, the delay in getting RWCU blowdown on and having CRD water injecting because the scram was not reset, the 1C RFP tripped due to high reactor water level at 0115. As water level began decreasing the 1B RFP was started per procedure QOP 3200-2, Startup of the First Reactor Feed Pump. This procedure requires the closing of the RFP discharge valve prior to starting the pump. The Nuclear Station Operator (NSO) started the pump and began opening the discharge valve.

Knowing that the valve switch HS! was a seal in switch, and having observed both of the discharge valve position indicating lights IL! illuminated, denoting that the valve was traveling open, he moved to the low flow FRV controls to adjust that valve's position. When the low flow FRV was opened, no flow was observed, therefore, the NSO opened the main FRV. Because feedwater flow was still not present and reactor water level continued to decrease, the Shift Engineer (SE) directed the Unit NSO and the extra NSOs to insert a manual scram to utilize the additional water from the Control Rod Drive (CRD) AA! system, manually start Reactor Core Isolation Cooling (RCIC) BN!, torus cooling BO!, and the 1C RFP. The NSO noticed the indicating lights for the 1B RFP discharge valve were not illuminated, indicating a tripped breaker BKR!, and started the 1C RFP. RCIC injected for approximately 15 seconds before the 1C RFP was started and began injecting. The main FRV was left in the open position, therefore, when the RFP began injecting, the reactor water level increased rapidly. At 0131 hours, the 1C RFP tripped off when the reactor water level reached the +48 inch trip setpoint. The 1C RFP was re-started at 0138 hours and the plant was stable at 0140 hours.

An Emergency Notification System (ENS) phone notification of the event was completed at 0209 hours on March 10, 1990, to comply with the requirements of 10 CFR 50.72(b)(2)(ii).

C. APPARENT CAUSE OF EVENT:

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv), which requires the reporting of any event or condition that results in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

The cause of this event was component failure. The circuit board for the negative-sequence time overcurrent relay caused the relay to actuate.

The negative-sequence time-overcurrent relays are General Electric (GE) type SGC 21 and are designed to protect the generator against possible damage from unbalanced currents resulting from prolonged faults or unbalanced-load condition. When a generator is subjected to an unbalanced fault or load, its stator current will include a negative-sequence component that sets up a counter-rotating flux field. This in turn causes double-frequency currents to flow in the rotor which results in localized heating.

The SGC relay must see a negative-sequence current greater than the threshold setting and last as long as the trip timer setpoint before the relay initiates a trip.

A digital fault recorder connected to line 0402, Quad Cities Station to Barstow Substation, indicated a fault did exist on the C phase, but only for a two cycle duration. The fault was most likely the result of a lightning strike. The fault and time duration were not sufficient in magnitude to cause the relay to actuate had the relay acted correctly. A bench test of the relay by the Operation Analysis Department (OAD) showed the relay was working correctly including the trip setpoints. However, when the relay was subjected to electrical noise, it would falsely trip.

During the course of testing the relay, one of its circuit boards was replaced as recommended by a Service Advisory Letter (SAL) under work request Q83035. Although the SAL did not address the noise problem that the relay experienced, subsequent testing of the relay showed that the relay noise problem was mitigated when the new circuit board was installed.

Investigation of the 1B RFP discharge valve discovered that the torque switch bypass limit switch setting was out of adjustment, the

belleville spring pack was hydraulically locked, and the thermal overload heater was undersized. The spring pack being hydraulically locked resulted in the pump discharge valve breaker tripping. The indication light for the 1201-5 was found burnt out and replaced.

D. SAFETY ANALYSIS OF EVENT:

The safety significance of this event is minimal. All expected ESF actuations occurred as designed to bring the reactor to a safe shutdown condition. The turbine-generator load reject scram occurs when there is a mismatch between the main generator electrical output and the turbine power output when steam flow is greater than 45 percent. This scram is intended to prevent exceeding the minimum critical power ratio (MCPR) safety limit by anticipating the rapid increase in pressure, neutron flux and heat flux which result from a fast closure of the turbine control valves. If the turbine-generator load reject scram had failed, a reactor scram would still have occurred from an Average Power Range Monitor (APRM) high neutron flux.

E. CORRECTIVE ACTIONS:

The immediate corrective action was to bench test the negative-sequence time overcurrent relay and to replace the circuit board. Subsequent testing of the relay, including application of noise, did not reproduce a false trip.

Several repairs were made to the 1B RFP discharge valve operator. The torque switch bypass limit switch was adjusted according to current criteria. Grease reliefs are being installed on MOVs at each available opportunity to prevent the motor operator from a hydraulic lock condition. The hydraulic lock condition is a result of a change in viscosity of the grease used in the operators. The change in grease provides the benefits of better lubrication. Additionally, the thermal overload heaters on the other discharge valves, including Unit Two, were re-evaluated utilizing Commonwealth Edison's current design guide for thermal overload heater selection current. The design guide was developed in accordance with IE Bulletin 85-03 and Regulatory Guide 1.106 Position C.2. All but the 1A RFP discharge valve thermal overloads were found to be undersized. The 1B and 1C heaters were corrected and the Unit Two RFP discharge valve overloads will be resized prior to startup from the current refuel outage (NTS 2542009002101).

The 1B RFP discharge valve operator motor was replaced as a precautionary measure because of magnesium rotor concerns.

An evaluation to determine the preventive maintenance requirements for these valves will be completed (NTS 2542009002102). To further enhance the procedure, QOS 3200-2, will be revised to provide guidance on when the discharge valve is required to be closed when starting a pump (NTS 2542009002103).

F. PREVIOUS EVENTS:

There have been no other occurrences of a scram being caused by a failure of the negative sequence time overcurrent relay since 1980.

G. COMPONENT FAILURE DATA:

The negative-sequence time overcurrent relay is manufactured by General Electric, Model Number 12SGC21A.

ATTACHMENT 1 TO 9004180239 PAGE 1 OF 1

Commonwealth Edison
Quad Cities Nuclear Power Station
22710 206 Avenue North
Cordova, llinois 61242
Telephone 309/654-2241

RLB-90-107

April 9, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: Quad Cities Nuclear Power Station
Docket Number 50-254, DPR-29, Unit One

Enclosed is Licensee Event Report (LER) 90-004, Revision 00, for Quad Cities Nuclear Power Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(iv): The licensee shall report any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

R. L. Bax

Station Manager

RLB/MJB/djb

Enclosure

cc: R. Stols
R. Higgins
INPO Records Center
NRC Region III

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